THE FALL MIGRATION ROUTE OF KIRTLAND'S WARBLER

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Kirtland's Warbler (*Dendroica kirtlandii*) is an exceedingly rare species with highly specialized habitat requirements for breeding. It has been well studied on the breeding grounds, but is little known as a migrant or on the wintering grounds. From time to time the species has been recorded during spring migration when the males may sing, drawing attention to themselves, but well documented fall migration records are exceptionally rare. In the autumn of 1971 we had the good fortune to band a migrant Kirtland's in southwestern Pennsylvania. This was an exciting event for several reasons: it was the first well documented Pennsylvania record for the species; it was the first fall banding of a migrant outside of Michigan; and the bird was rehandled at our banding station twice after it was banded, allowing us to make a limited analysis of habitat preference, weight change, and correlation of its migratory behavior with weather patterns. Perhaps most important, this Pennsylvania record may throw new light on the little known fall migration route of the species.

THE PENNSYLVANIA RECORD

On 21 September 1971 at 10:15, Robert C. Leberman captured a Kirtland's Warbler in a mist net at Carnegie Museum's Powdermill Nature Reserve, three miles south of Rector, Westmoreland County, southwestern Pennsylvania (40° 10′ N, 79° 16′ W). Realizing that this was an important record and should have verification he telephoned Kenneth C. Parkes and the author at the museum in Pittsburgh. We quickly gathered up study skins representing the various plumages of the species and drove to the Reserve. Upon seeing the bird we confirmed the identification. It was an immature individual, as indicated by the only partly pneumatized skull and heavy streaking on the breast plumage. We could not definitely determine its sex because immature Kirtland's Warblers are not known to be sexually dimorphic (Van Tyne, 1953).

After identification the warbler was measured, weighed, banded, photographed, and released. Its measurements were: unflattened wing chord, 67.5 mm; tail, 55 mm; exposed culmen, 10.7 mm; tarsus, 20 mm. It weighed 14.0 grams and had a trace of visible fat in the furcular region. To document the record color photographs were taken. Several of the pictures are now on file at Carnegie Museum and one in black and white appeared on the cover of the November, 1971, issue of *Carnegie Magazine*.

On 26 September, five days after it had been banded, the warbler was

recaptured at Powdermill at 11:50; it weighed 14.9 g and had no visible fat deposits. On 2 October at 17:40 it appeared again, weighing 15.8 g and with a small amount of visible fat (index of 1 on a scale of 0–3).

When the Kirtland's originally was netted it was found in the company of several other parulids in a net lane cut through a dense old field hawthorn (*Crataegus* spp.)—crabapple (*Pyrus coronaria*) thicket. The lane is located slightly above the floor of the Ligonier Valley (elevation approximately 1,350 feet) and extends from the edge of a dirt road through the thicket for approximately 45 meters, then crosses a small open marsh and ends in another but more open old field hawthorn-crabapple thicket. The total length of the net lane is 120 meters. In the same general area of the Reserve 33 additional nets are operated, but in different types of habitat: willow thickets bordering streams and a pond; old fields in different stages of succession: second-growth forest, etc. The 45 meter stretch of the net lane in which the Kirtland's Warbler was originally found is unique within the banding area in terms of density and height of the hawthorn and crabapple trees.

When the bird was captured on 21 September it was carried to a banding office some 250 meters from the net lane: after banding it was released near the office. On the second capture the Kirtland's was transported and released near a different banding office, some 880 meters from the capture lane. Regardless of the release site it returned *both* times to the same 45 meter stretch of the same net lane, and was netted with other warbler species. The repeated appearance of the Kirtland's in the same hawthorn-crabapple thicket would seem to indicate a preference of this individual for this type of habitat. The region in and around Powdermill lacks any habitat similar to the jack pine scrub of the Michigan breeding grounds.

The weather records during the period the Kirtland's was at Powdermill show an interesting correlation of wind direction with the probable migration direction of the bird. According to the U.S. Weather Bureau at the Pittsburgh airport (approximately 56 airmiles WNW of the Reserve) northwest winds developed in the early evening of 20 September: during the two previous days the winds had been from the south. The northwest winds continued until the late afternoon of 21 September, several hours after the warbler had been caught and banded. For the entire eleven-day period the bird stayed at Powdermill the winds did not come from the northwest quarter except for very brief periods. Two days after the warbler was last handled the winds swung around and blew from the northwest, from the evening of 4 October until the morning of 8 October.

The Reserve banding records indicate that although the Kirtland's remained in the area from 21 September at least through 2 October, considerable numbers of migrants were passing through the region during that period.

On 21 September the capture rate at the banding station was 0.91 birds per net hour, with a total of 145 birds of 33 species (including 99 warblers of 16 species). In the following days through 2 October the capture rate remained high (for the Powdermill station): 0.48 birds per net hour, with 1,146 birds banded, or 104 birds per banding day. During the same period, 21 September–2 October, in the previous five years, with more nets open for longer periods (av. 3,062 net hours 1966–70 vs. 2,390 in 1971) the capture rate was lower: 0.29 birds per net hour, or 85.6 birds per banding day. Thus it is clear that a higher than normal amount of migratory activity occurred at Powdermill while the Kirtland's was present.

Yet with all this movement of other species, the warbler remained. It apparently had a habitat preference, and it was gaining weight (1.8 g, an increase of 13 percent over its original capture weight). The layover period was a minimum of eleven days, presumably a long time for a migrant passerine.

The most reasonable explanation for this delay is that although other birds were actively migrating (the winds were out of the northeast quarter for a total of six days, the southeast for one, and the southwest for four), the Kirtland's was waiting for a more favorable wind. It had been banded, apparently as a new arrival, during a period of northwest winds and it remained in the area at least until two days before the next northwest winds began. After that second period of northwest winds the bird was not seen again. The association of this warbler with a particular wind direction, therefore, seems fairly clear and reasonable. Powdermill lies to the southeast of the Michigan breeding grounds, hence a bird migrating from there on a northwest wind might easily come down in southwestern Pennsylvania. A second period of northwest winds would take the warbler toward the southeastern states, where it could then continue south to the wintering grounds in the Bahamas.

Support for our belief that the Powdermill bird was not an "accidental" (an individual well outside the normal migration route) comes from two other southern Pennsylvania records. On 26 September 1972, an "adult male" was watched for over an hour while it fed with other warbler species on insects in "sweet birch" growing on abandoned strip mine spoil on a hill above Wellersburg, Somerset County (McKenzie, 1973: in litt.). Wellersburg is less than 45 airmiles SE of Powdermill. Mr. McKenzie saw the bird at close range and described it well; unfortunately he was alone at the time and did not have a camera with him, but otherwise his is a convincing description of a Kirtland's Warbler. At the time he apparently was unaware of the Powdermill banding record. An earlier sight record from Lewisville, Chester County, in the southeastern corner of Pennsylvania, is similarly well

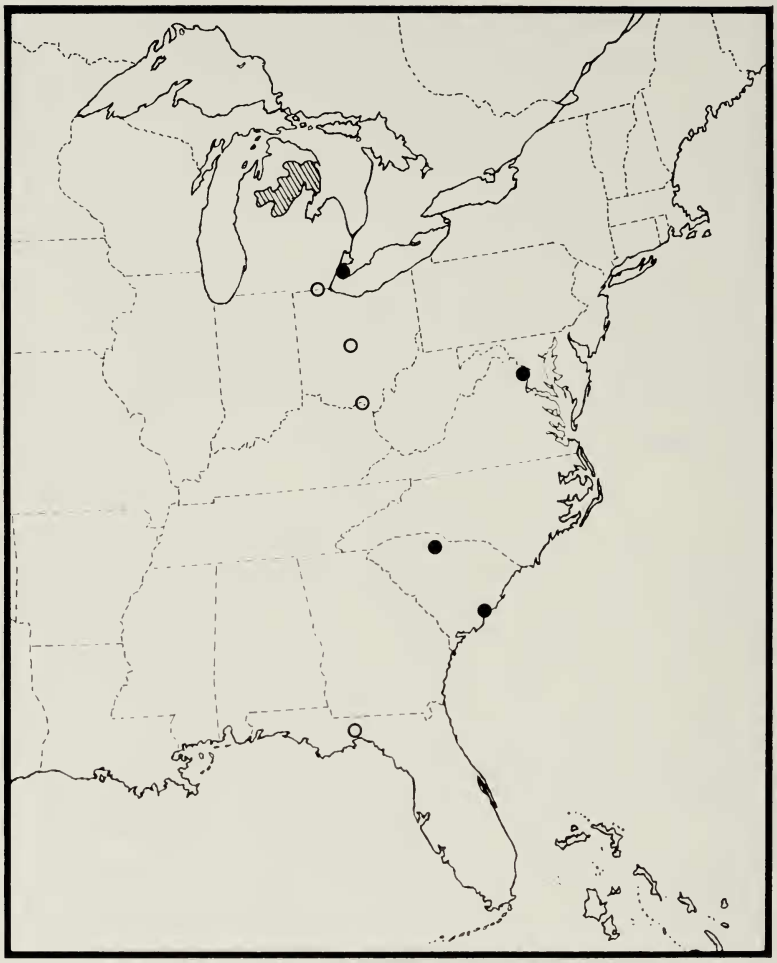

FIG. 1. Fall migration records of Kirtland's Warbler as mapped by Van Tyne. Solid circles represent specimen records; open circles, accepted sight records; hatched area, known breeding grounds. Redrawn from Van Tyne (1951).

described but undocumented. The bird was in "full breeding plumage" and recorded on 27 September 1964, by a single observer who had had previous experience with the species on the breeding grounds (B. Hurlock, D. Cutler, in litt.).

OTHER FALL RECORDS

What little is known about the fall migration route of Kirtland's Warbler was first summarized by Van Tyne (1951). Van Tyne also was almost entirely

TABLE 1

FALL MIGRATION RECORDS OF KIRTLAND'S WARBLER*

Locality	Date	Type	Reference
Ontario			
Point Pelee	2 Oct. 1915	Specimen	Mayfield, 1960
Michigan			
Bloomfield Hills	24 Sept. 1965	Banding	W. P. Nickell, AFN**, 20:52
Ohio			
Bowling Green	28 Sept. 1969	Sight	V. B. Platt, in litt. to Mayfield
Buckeye Lake	Sept. 1928	Sight	M. B. Trautman, in litt. to Clench
Cleveland	14 Oct. 1886	"Specimen"	Davies, 1906
Cleveland (Hudson)	25 Oct. 1969	Sight	J. N. Henderson, in litt. to Mayfield
Columbus (Alum Creek)	11 Sept. 1925	Sight	Thomas, 1926
Ironton	28 Aug. 1902	Sight	Jones, 1903
Toledo	22 Sept. 1929	Sight	Mayfield, 1960
Pennsylvania			
Lewisville	27 Sept. 1964	Sight	B. Hurlock, AFN, 19:24
Rector	21 Sept.–2 Oct. 1971	Banding	This paper
Wellersburg	26 Sept. 1972	Sight	McKenzie, 1973
Virginia			
Fort Meyer (Arlington)	25 Sept., 2 Oct. 1887	Specimen, sight	Smith & Palmer, 1888
North Carolina			
Rocky Mount	2–23 Sept. 1936–41	Sight (3 dates)	Mayfield, 1960
South Carolina			
Chester	11 Oct. 1888	Specimen	Loomis, 1889
Christ Church Parish (nr. Charleston)	4 Oct. 1910	Sight	Wayne, 1911
Mt. Pleasant (nr. Charleston)	29 Oct. 1903	Specimen	Wayne, 1904
Florida			
E. Goose Creek (20 mi. W. St. Marks)	9 Sept. 1919	Sight	Mayfield, 1960
Miami	21 Sept. 1958	Sight	R. L. Cunningham & A. Schaffner, AFN, 13:24
West Palm Beach	2–3 Nov. 1961	Sight	V. I. Carmer, AFN, 16:24
Alabama			
Jacksonville	5 Oct. 1966	Sight	W. J. Calvert, AFN, 22:53

* Accepted by Van Tyne (1951) and in the present paper
** AFN = Audubon Field Notes

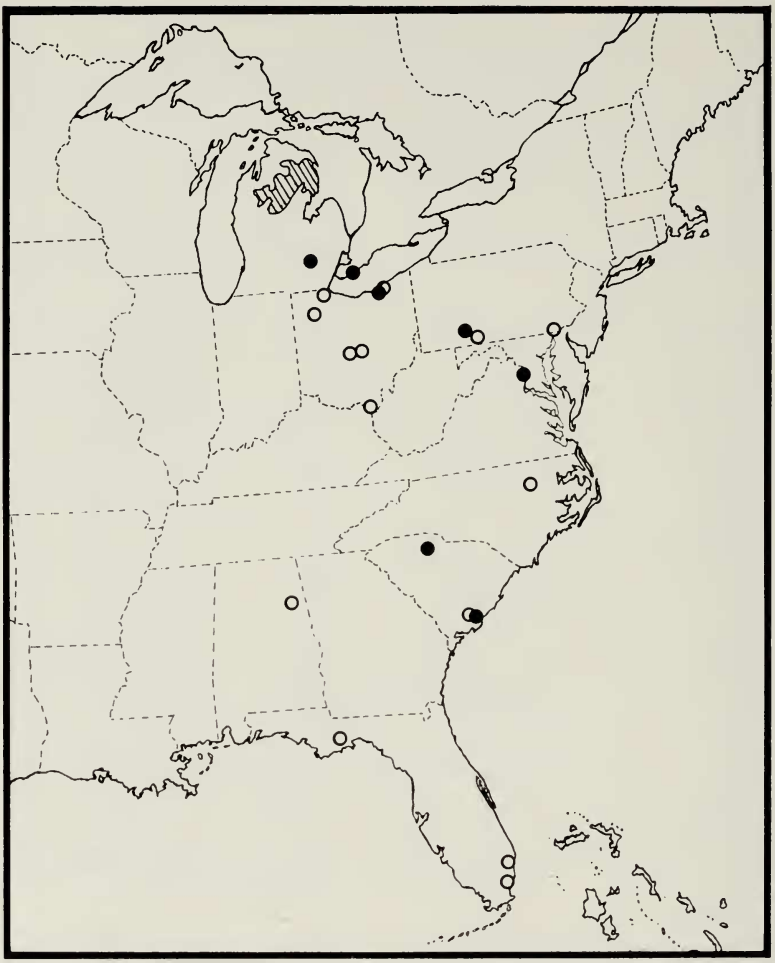

FIG. 2. Accepted fall migration records through 1972. Conventions as in Fig. 1 (banding records also shown as solid circles).

responsible (Mayfield, in litt.) for the section on fall migration records in Mayfield's excellent monograph on the species (1960). In both publications the same map (Fig. 1) was used to illustrate the accepted fall migration records. The later publication also includes a list of localities and dates for each record. In comparing the list of records with the map I found several puzzling discrepancies: four of the listed records are not spotted on the map and three of the map spots are not listed. I then wrote to Dr. Mayfield and he kindly sent me all of his and Van Tyne's notes and correspondence on the

fall migration records. In addition to studying this material, I have also searched the literature through 1972 in an effort to gather together all the records, substantiated or otherwise, for analysis.

I found that the Van Tyne map is actually missing only two records that he accepted: one for a specimen from Cleveland, Ohio in 1886, and one for three sight records at Rocky Mount, North Carolina from 1936 through 1941. The third, apparently missing, record was erroneously listed as Oberlin, Ohio but correctly spotted on the map at Ironton on the Ohio River. The fourth, a sight record from the Charleston, South Carolina area, could have been omitted because of the specimen already marked for that locality on the map. The unlisted map spots are both valid records: one a sight record from Columbus (Alum Creek), Ohio in 1925 and the other a specimen taken in interior South Carolina (Chester) in 1888. All these previously accepted records and others made in recent years are detailed in Table 1 and mapped in Figure 2.

The following sight records (listed alphabetically by states) known or suspected to have been rejected by Van Tyne and/or rejected by me have not been included in Table 1. Arkansas: Arkansas County, 23–28 Sept. 1936 (Baerg, 1951); Harrisburg, 11 Sept. 1972 (in litt. to Mayfield). Florida: Fort Pierce, 1 Nov. 1918 (Sprunt, 1954); Chokoloskee, 11 Oct. 1915 (Sprunt, 1954); Pensacola, 26 Nov. 1953 (Sprunt, 1954); Princeton, 25 Oct. 1915 (Sprunt, 1954). Georgia: Savannah, 27 Aug. 1909 (Burleigh, 1958). Kentucky: Bowling Green, 28 Sept. pre-1922 (rejected by Mengel, 1965). Missouri: Weldon Springs, 29 Sept. 1950 (in litt. to Van Tyne). Ohio: Canton, 2 Sept. 1939 and 9 Sept. 1939 (in litt. to Van Tyne); Cleveland, eight dates between 2 Sept. and 7 Oct. 1934–46 (Williams, 1950); Zanesville (Dillon Dam), 3 Sept. 1962 (Hurley, 1963). South Carolina: Eastover, 14 Oct. 1949 and 1 Sept. 1951 (in litt. to Van Tyne). Virginia: Bristol, a specimen supposedly collected sometime in the fall, no date specified (Jones, 1931). A few other records in the Van Tyne correspondence are too inexact or fragmentary to identify. I have listed these rejected records so future workers will know which of the records have already been taken into consideration.

DISCUSSION

In assembling all the known fall migration records for Kirtland's Warbler I have found only two that were, to my mind, completely satisfactory indicators of the route the species is *presently* taking. These two records are the 1971 Powdermill banding and an individual banded by Walter Nickell at Bloomfield Hills, Michigan, in 1965. Most of the others are sight records, and although undoubtedly many are valid they are nevertheless subject to the

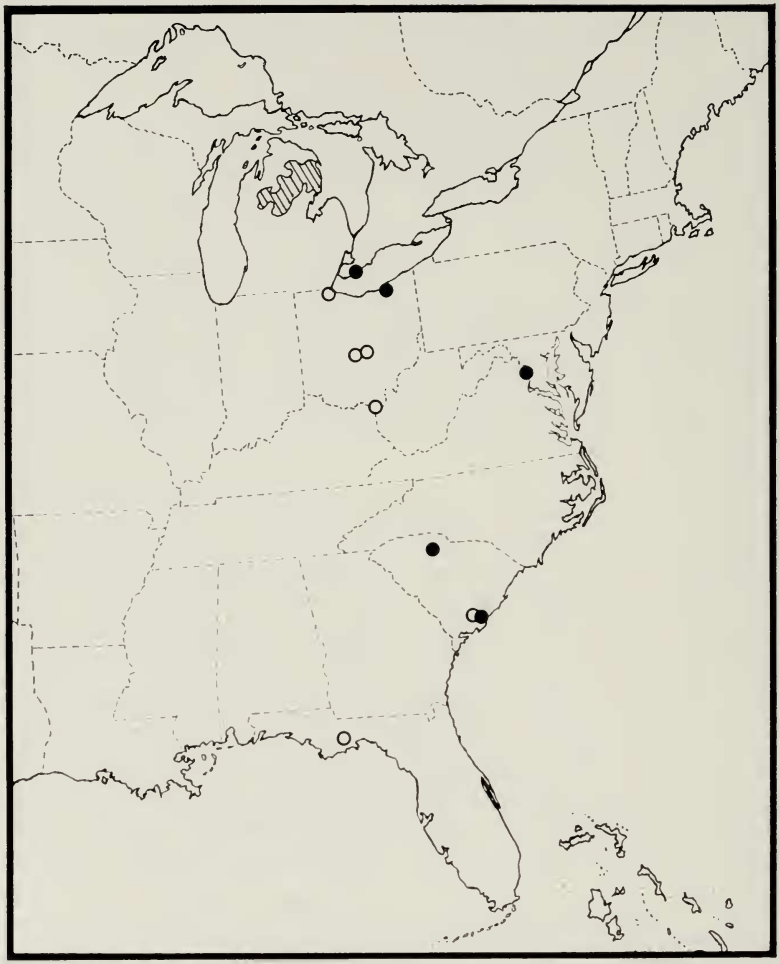

FIG. 3. Accepted fall migration records made before 1935. Conventions as in Fig. 1.

doubts that may be applied to *any* sight record. Specimen records are few, only five, and all over 50 years old: three from 1886 to 1888, one in 1903, and one in 1915. Of course in recent years, because of the species' low populations and official endangered status, it has been unwise or illegal to collect any birds that otherwise might have been secured for unquestioned records.

The greatest problem with the older records is that Kirtland's Warbler apparently has undergone striking changes in population and range size within the last 100 years. It is believed that the species enjoyed an expanded range

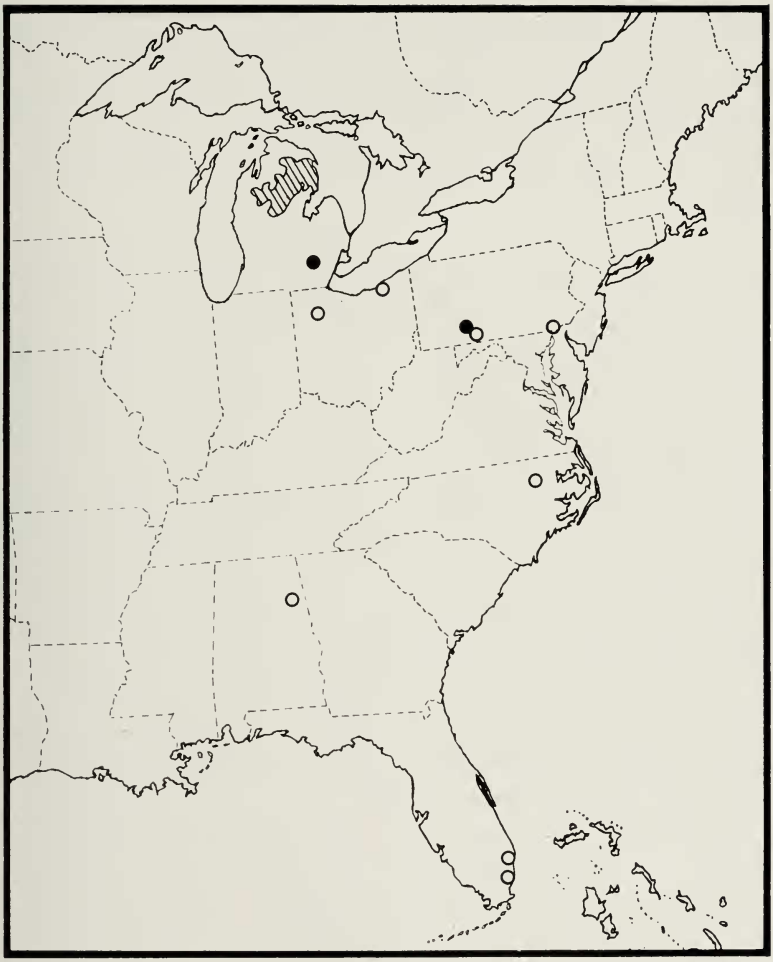

FIG. 4. Accepted fall migration records made after 1935. Conventions as in Fig. 1.

and population between 1885 and 1900. Mayfield (1960:41; legend to Fig. 5 adapted from Van Tyne, 1951) points out some of the spring migration records between 1885 and 1900 that are well "outside the normal migration route . . . when these birds are believed to have been more numerous than before or since." Van Tyne (1951:542) in the legend to the same map states "The dated records, occurring from 1885 to 1900, are those of birds which seem to have been en route to some nesting ground other than that now known." In addition, the population may have suffered a serious decline after about 1934 (Milton Trautman, in litt.; Mayfield, 1960:40) from which it

eventually at least partially recovered only to show another marked population loss in the last decade (Mayfield, 1972). All of this means that when considering fall migration records, one must take into account when the records were made and the probable state of the species' population at the time. Certainly the very early records, before 1900, must be considered as coming from a period of relative abundance and possibly representing migration routes that are no longer in use.

To see if any differences were apparent between earlier records and those made in recent years, I mapped the records made before and after 1935 (Figs. 3 and 4). As might be expected, the pre-1935 map is similar to Van Tyne's, and indicates a relatively straight-line, SSE route between the breeding and wintering grounds. The more recent records, however, suggest a more directly eastward route from Michigan, across northern Ohio and southern Pennsylvania (crossing the Appalachians at a relatively low point) and then perhaps following the Piedmont or the inner coastal plain to the southeast coast before the over-water flight to the Bahamas. I doubt that the species reaches the coast north of South Carolina. The evidence for this belief is negative: no Kirtland's Warbler has *even* been seen on the coast north of the Charleston region. With the many hundreds of thousands of fall migrants that have been banded in recent years by coastal stations from New Jersey to Virginia, and with the many bird watchers that frequent the middle Atlantic coast during autumn, if the species did occur there with any regularity, it probably would have been recorded at least once. One might also reasonably suppose that the "Jack Pine Warbler" would find the extensive pinelands of the Piedmont and inner coastal plain attractive habitat.

It is also possible (Fig. 2) that some individuals may travel from Michigan via the western side of the mountains. A few accepted sight records indicate this route, and a number of the rejected records are also from this western area. It is not possible to say which of these unsubstantiated records may actually be valid, but by their very numbers I suspect that at least a few of them may be true sightings.

The direct route, SSE, crossing the Appalachians in Kentucky, Virginia, Tennessee, or the Carolinas, may also be used as suggested by the records in Fig. 3. We have no knowledge of whether mountains such as those in the southern Appalachians are sufficiently high to deflect this species on migration. Perhaps these mountains are not a serious barrier to a migrating warbler, yet *none* of the existing records come from within the southern mountains. The Chester, South Carolina, specimen is not, as it might first appear, from the mountains, but from well within the Piedmont. This specimen was also collected after a heavy gale and the bird might have been blown into the locality from elsewhere. The only montane records of the species, therefore,

are both from southwestern Pennsylvania: the 1971 Powdermill banding and the 1972 Wellersburg sight record.

Hopefully field observers and banders from Ohio and Pennsylvania south, and especially those working in the southern mountains and Piedmont, will keep these possible additional migration routes in mind and be on the lookout for the species in the fall. Rare as Kirtland's Warblers now are (only about 200 pairs in the 1971 census) they still *must* pass through the eastern U.S. twice a year and, with luck, can be recorded.

This, then, is the existing evidence on the fall migration route of Kirtland's Warbler: a very sparse record consisting of 21 localities, only seven of which are adequately documented. Of these seven, five are specimens collected between 1886 and 1915, a period when the species is believed to have been more numerous and with a larger breeding range than is now the case; and two are bandings, both within the last decade and the only completely satisfactory modern records. The remainder are sight records which, although apparently valid, are still sight records and thus open to question. Since Van Tyne's compilation, however, nine records have been added to the twelve earlier ones, and the resulting picture is no longer of a straight-line, SSE route leading directly from Michigan to the Bahamas. The evidence is still too sparse to allow a definite statement on the present (or past) fall migration route of the species. It is fairly clear, however, that not all birds now follow the route suggested by the Van Tyne map. It is also probable that several routes are (or have been) used, either by different segments of the population, by different age or sex classes, or in response to varying weather conditions. How or when these various routes may be used cannot be explained by the present data. One might also hazard the (perhaps overly optimistic) guess that Kirtland's Warbler may have breeding grounds in addition to those known in Michigan, and thus in the fall is coming from regions we know nothing about.

ACKNOWLEDGMENTS

I am grateful to the many people who, through correspondence, helped me to find and assess many of the records: Charles H. Blake, David A. Cutler, Frank B. Gill, George A. Hall, Douglas A. James, Paul M. McKenzie, Frederic R. Scott, Milton B. Trautman, and William L. Wylie. I am especially indebted to Harold F. Mayfield who showed warm interest in the study, generously lent me his and Josselyn Van Tyne's files on fall migrants, and routed several recent records to me for inclusion in this paper. I also thank Robert C. Leberman, the resident bander at Powdermill, whose perspicacity and luck initiated the study, and A. C. Lloyd, our devoted weekend volunteer for his continuing contribution to the Reserve banding program. Harry K. Clench and Kenneth C. Parkes read the manuscript and offered several helpful comments; Dr. Parkes also provided stimulating discussion on the problem at several stages in the study. The illustrations were prepared by James Senior.

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